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ABSTRACT

This research was undertaken to study the effectiveness of elementary school teachers with pupils, aged 8, entering Gambian schools. The investigator attempts to describe what teachers do, to search for associations between theoretically or empirically derived variables and learning, and to infer the power of given factors in instructional procedures which may make practical differences in sought outcomes. Following a review of relevant literature on teacher effectiveness, the methodology of the study is outlined. The sample included 16 urban, semi-urban, and rural elementary schools. Observations, lesson plan assessments, teacher questionnaires, and pupil achievement tests were employed. Data were analyzed in terms of class size, teachers' qualifications, teachers' experience levels, lesson preparation, classroom environment, classroom communication, teachers' attitudes, pupils' attainment of Primary 1 mathematics objectives, problems of teaching Primary 1 mathematics, and correlations between variables. Finally, conclusions and recommendations are given. Appendices contain the teacher questionnaire, the observation and assessment guide, and achievement test items. (MNS)

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AN INVESTIGATION INTO THE EFFECTIVENESS OF TEACHING MATHEMATICS IN PRIMARY ONE OF GAMBIAN SCHOOLS

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MALICK ALIEU SALLAH:

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IN PRIMARY ONE OF GAMBIAN SCHOOLS

1982

AGC Project

GTZ, Att. Peter Sachsenmeier
PO Box 54845, Nairobi

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This research project was undertaken as part of a training programme jointly organised on behalf of the African Curriculum Organisation (ACO) by the Kenya Institute of Education (KIE), the University of Nairobi, and the German Agency for Technical Cooperation (GTZ).

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AN INVESTIGATION INTO THE EFFECTIVENESS
OF TEACHING MATHEMATICS IN
PRIMARY ONE OF GAMBIAN SCHOOLS

BY

MALICK ALIEU SALLAH

B.Sc. (ED) UNIVERSITY OF SIERRA LEONE, 1979.

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M.A.S.

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CHAPTER 1

INTRODUCTION

1.1 Background To Study

Primary School Education in the Gambia lasts for six years - Primaries one to six - the entry age being eight years. This entry age to primary schools was raised from six to eight with effect from September 1975, following a government policy pronouncement. To many parents, this increased primary school entry age has been unwelcomed as they considered it an unnecessary burden to retain their children for a further two-year period before school doors in the formal system of education are opened to them. Thus, since 1976 several nursery schools have been instituted by private organizations in order to meet the demands of enthusiastic or impatient parents. But the government had been convinced of the soundness of the idea of increasing the primary school entry age, since less than 40% of children who go through the primary schools will have the chance of proceeding with any sort of post primary schooling. This means that the majority of primary school graduates are only disposed to take up self employment or non-formal vocational education, requiring a minimum physical development that an age of twelve cannot normally provide. Thus, with an increased entry age of eight, it is considered that after six years of schooling, children would have reached the age of fourteen at which they would be physically fit to undertake apprenticeship in vocational fields in the absence of the chance to follow further formal education.

As a developing country whose educational system was grounded in a colonial pattern, the Gambia, since Independence, had become increasingly aware of the irrelevance of the school curriculum, inherited from the colonialists, to the socio-economic needs of the country. Just before the Gambia attained independence, the Education Policy of 1961-65 brought into effect the six-year primary school course as an improvement of what used to prevail. Before this Policy came

into force, Missions had pursued a policy in which children did a three-year Infant Course followed by seven years of primary course (Standards 1 - 7), entry age being left to the discretion of parents. The 1961-65 Education Policy of the Gambia proposed, among others, that a six-year primary course shall be made progressively available to all Gambian children (average rate of enrolment to primary 1 around this time was about 3000 per annum, much less than the present enrolment to Primary 1 of over 10,000).

Between 1965 and 1975, primary education was based on the recommendations of the Sleight Report - "The Development Programme in Education for the Gambia, 1965/75" (Sessional Paper No. 8 of 1966). Among Dr. Sleight's recommendations, two are relevant to our study:

- i. "that the primary school syllabus be revised and made available in all schools". (1.9.2)
- ii. "that supervision and in-service training be improved and systematized". (1.9.3 and 1.9.4)

But whereas in-service courses have become routine operations during this periods, it is doubtful how systematized they were and how effectively they contributed towards the improvement of teachers' performances. Indeed, an in-service course cannot be effective if it does not have objectives which earnestly seek to enhance the instructional objectives which are, at least, vaguely prescribed by teaching syllabuses. But up to 1976 when the Curriculum Development Centre of the Gambia was established, no national and systematically developed syllabus was ever prepared for use in all Gambian primary schools. It must be admitted that there have been attempts to prepare syllabuses for use in schools in the sixties, particularly in 1965, but such ventures were restricted. Lecturers at the only Teacher Training College in the Gambia (then called Yundum College) were assigned by the Director of Education to draft syllabuses for the primary school course in their respective subject areas. These drafts, mainly lists of topics to be taught, were then reviewed by subject panels which were mainly composed of senior subject masters in the existing high schools, selected head-teachers who manifested interest in particular subject areas and, of course, lecturers at the Teacher Training College. Considering the teaching experience and training of such panel members it is doubtful how effective they could have been in designing a

hensive and practical primary school syllabuses.

With the establishment of the Curriculum Development Centre (C.D.C.) in 1976, a systematic approach to reforming the school Curriculum (initially at the primary level) was undertaken. The reform programme was guided by the following underlying principles:

1. relevance to National needs;
2. relevance to the needs of Gambian children and youths;
3. relevance to local environment;
4. interdisciplinary approach.

Thus the syllabuses whose development the C.D.C. co-ordinated were not merely shop lists of topics to be taught; but they elaborately included unit objectives as well as suggested teaching aids, lesson activities and evaluation procedures.

Present trends in the Gambia's education system is expected to be influenced by the Education Policy 1976-86. As far as mathematics education is concerned, this policy stipulated that the Curriculum at the first (primary) level of education shall be "mathematical processes to enable the child to develop precision, problem solving and effective thinking amongst other skills" (2.4.66). The 1976-86 Policy has not overlooked the concomitant issues such as classrooms and school furniture. It appreciates the fact that "the child, teacher and school environment if harmoniously integrated will serve as a stimulus for improvement....

....."
(2.6.1). With regards to school furniture the Policy states that "school requirements will be costed and adequate provision made annually to allow for the planned expansion and replacements"

(2.7.1). However, two significant events characterized Gambia's education system since the commitment of this policy: rapidly increasing primary school population (25513 in 1976/77 to 43432 in 1980/81), and the declaration of free (fee free) primary education in 1976. Considering the financial implications of these events in the midst of unfavourable national and global economic crisis, the question of the progress made in the intended directions becomes relevant and evaluative.

1.2 Recruitment, training and supervision of Primary School Teachers

Primary school teachers are mainly recruited from secondary schools, but the vast majority of these teachers are products of Junior Secondary Schools. People who proceed to the fifth form of High Schools and perform well in their Ordinary Level Exams (G.C.E. or School Certificate) hardly opt for a permanent career as a primary school teacher. Thus the potential labour force of teachers of primary schools is of a mediocre level. Furthermore, about 64% of primary school teachers (1058 out of 1650, in 1980/81) were untrained or unqualified.

Over the past ten years it has been a practice, facilitated by the Department of Education and the Gambia Teachers' Union, to provide school leavers or prospective teachers with a two or three-week pre-service training before employing them as unqualified teachers. For teachers already in the service, qualified as well as unqualified, two-week in-service courses are held, organized by the Gambia Teachers' Union, Headmasters' Association, Gambia College and the Curriculum Development Centre. The in-service course organized jointly by the Curriculum Development Centre and the Gambia College are meant to familiarize teachers concerned with the newly developed curriculum materials to be pilot tested or implemented, as the case may be. But such courses have their pertinent problems, mainly financial, as a result of which it is not feasible to hold courses long enough to effect any marked changes in the attitude and efficiency of the teachers attending these courses.

Supervision of teachers in their classroom deliberations has dismally been very inadequate. There has not been any Inspectorate Division of the Ministry of Education and the machinery created by the Department of Education to undertake the role of inspection of teachers' activities has also been very inadequate and ineffective. If there is any supervision of teachers in their classrooms, it is done by senior teachers and these personnel are generally not conversant with the new curriculum materials.

1.3 The Primary One Mathematics Programme

The mathematical ideas inherent in the Gambia Primary Mathematics Programme are categorized under Number, Operations on Number, Geometry, Measurement, Statistics and Problems solving. Topics falling in this categorization are spirally developed right through the primary course. To many, topics like 2 - and 3 - Dimensional shapes and Sets may seem absurd and inappropriate for Primary One, but such a feeling rests on misunderstanding. Modern trends in the teaching and learning of primary mathematics have sought to improve the learning process of every child and to introduce the study of basic mathematical ideas earlier than in the past. The change in method is less of direct teaching and rote learning and more of providing experience and opportunities for children to discover facts and relations in mathematics. The child is no longer regarded as a receptacle for knowledge; the teacher merely helps the child to form ideas by providing suitable activities, just like the midwife helps the woman in labour to give birth to a child.

Considering the developmental stage of pupils in primary one and the concept formation processes involved, the Gambia Primary Mathematics Course anticipates that by the end of Primary One, the child should be able to:-

1. recognize a set as a collection of objects having a common property;
2. partition sets into subsets;
3. sort, compare and put objects in serial order, e.g. length, weight, capacity and size (of objects with identical shapes only);
4. understand and use correctly, orally and in writing, the numerals 1 to 50;
5. add and subtract numbers between 1 and 20, including the use of number bonds from 1 to 10;
6. use basic apparatus for comparing length, capacity and weight;
7. recognise the time on a clock at the full hour;

8. carry out simple and practical shopping/marketing activities using the coins (Gambian): 1 butut, 5 bututs, 10 bututs, 25 bututs and 50 bututs;
9. recognise 2 - dimensional shapes and 3 - dimensional solids, including intuitive idea of a straightness and roundness;
10. do simple problems involving objectives (1) to (9)

1.4 Purpose of Study

In looking for knowledge of teacher effectiveness with respect to the teaching of mathematics in Primary 1, the investigator attempts to describe accurately what teachers do, to search for associations between theoretically or empirically derived variables and learning, and to infer the power of given factors in instructional operations to make practical difference upon outcome sought. Hence, this study was conducted in order to expose and examine the deficiencies in the teaching and learning of the Primary One mathematics course and to recommend measures that may enhance an effective teaching of the Primary One Mathematics Course, in the Gambia.

In view of these objectives, the study looked at the following:-

1. The comprehensiveness of lesson notes prepared by teachers;
2. The potentiality of the classroom environment in enhancing active learning;
3. The effectiveness of the teaching process in bringing about desired behavioural changes in pupils;
4. The preparation of teachers to enable them to use the mathematics materials effectively;
5. Problems encountered by teachers in teaching the primary one mathematics course;
6. The achievement of Primary One Pupils in their mathematics course.

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These criteria are used as the basis for measuring teacher effectiveness in the context of this study since each of them is either a facilitator or an indicator of success in teaching. However, in considering these criteria, the investigator is appreciative of the fact that evaluation of the effectiveness of teaching is a complex exercise since student growth and development result from all the experiences encountered by the student. Thus it is difficult to distinguish the effects of the teacher from other agencies and institutions in the learner's environment.

1.5 Significance of Study

No study on the effectiveness or competency in teaching any school subject has ever been carried out in the Gambia. This study could be a catalyst to boost up the morale of other Gambian educators to undertake similar research projects. The findings of this study can be very useful in revealing some soft spots in teachers' profiles. Such areas of weaknesses can then be the targets for improvement during in-service or pre-service courses for teachers. Inspectors and supervisors of schools as well as Curriculum developers can also use the findings of this study as a basis for evaluating and guiding teachers' activities in their classrooms. Also, since any genuine and progressive teacher aims at being effective, the findings of this project could serve as a checklist for self-improvement of teachers' competencies. For the investigator, this study is important in that it will provide the basis for describing fairly objectively and generally what sort of teachers teach in the Primary ones in the Gambia and, particularly, how such teachers may affect the subsequent learning of mathematics of the pupils that pass through them at this crucial stage.

1.6 Relevance of Study to Curriculum Development

Curriculum Development means more than syllabus or materials development. It includes the derivation of objectives, content, methods and assessment procedures; and in this process the part played by the teacher must be recognized. No matter how out-

standing the Curriculum materials produced, the successful implementation of it will ultimately hinge on the receptiveness and adaptability of the classroom teacher. Pupils may well be ready to receive new materials but if their teachers are not, these children are doomed to failure. Since the problems raised by this project point at the extent to which the teacher is up to date with the content, objectives, methodology, evaluation procedures and attitude with regards to the Curriculum, the relevance of the study becomes evident. This study could help to reinforce the curriculum development process in the Gambia by focussing attention on pertinent problems which characterize primary mathematics education. With these problems in the minds of mathematics educators, curriculum developers, and school inspectors, it is hoped that the new primary mathematics programme for the Gambia will gain a firm ground, for then, the obstacles to curriculum improvement in mathematics would not be lost sight of, with the effect that curriculum development efforts are misdirected.

1.7 Definition of terms

EFFECTIVENESS: As it concerns the teacher, effectiveness, is the extent to which teachers aid students to attain the objectives of the curriculum.

PRIMARY ONE (P.1): The first class of the first level of formal education.

TEACHING: "The art of assisting another to learn. It includes the providing of information and of appropriate situations, conditions, or activities designed to facilitate learning."
(English and English, 1958)

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CHAPTER 2REVIEW OF LITERATURE

In reviewing literature for this study, the investigator looks out for the definition of teacher effectiveness by various researchers into this concept. It is felt that an awareness of the multifarious conception of teacher effectiveness will guide the investigator as to the behaviours to be monitored in this study. Furthermore as a basis for structuring the study and constructing appropriate instruments for collecting relevant data, the investigator considers it instructive to intimate himself with factors which have been identified as determinants of teacher effectiveness. Various approaches used by previous researchers into teacher effectiveness and the limitations of such approaches, when known, would serve as guidelines for the design and methodology of this study. The investigator also has the contention that research literature in the empirical studies in which various kinds of teacher behaviour have been related to other variables desirable about teachers is a relevant guide. To carry out a study into teacher effectiveness is a sort of exercise on measurement of teaching activities and behavioural changes in learners. And to measure we need to know what to measure, what instruments to use in the process and how to make judgement on the data collected. However, all these components have problems associated with them. Reviewing pertinent literature may shed light on problems the investigator is to reckon with. The following paragraphs highlight some relevant issues which influence this study.

2.1 Teacher effectiveness: a controversial notion

The concept of teacher effectiveness has long remained a controversial one. Disagreement and ambiguity with respect to the description of teacher effectiveness are to be expected and cannot be avoided since the idea of 'competent teaching' is undoubtedly a relative matter. According to Ryans⁽¹⁹⁶⁰⁾ one may say that:

"Teaching is effective to the extent that the teacher acts in ways that are favourable to the development of basic skills, understandings, work habits, desirable activities, value judgments, and the personal adjustments of pupils. But this sort of definition is very abstract and

general and it not easily translateable into terms relating to specific teacher behaviours."

With regards to defining 'good teaching', which implies effective teaching, or specifying the distinguishing characteristics of competent teachers, little agreement seems to exist as to the relative importance of qualification such as intelligence, formal education, pedagogical training, interests and various personal and social characteristics. Ryans (1960) contends that:

"a person's concept of a good teacher seems to depend on (a) his acculturation, his past experience and value attitudes he has come to accept;
(b) the aspects of teaching which may be foremost in his consideration; and
(c) the characteristics of the pupils taught. A description of competent or effective teaching must, therefore, be considered to be relative to perhaps three major sets of conditions - the social or cultural group in which the teacher operates, the grade level and subject matter taught, and the intellectual and personal characteristics of the pupils taught."

Shaba (1981), in his Review of Literature concerning the subject of Teacher Effectiveness, cited the contentions of Mitzel (1960), Cope (1970), Biddle and Ellen (1964):

"Mitzel points out that although we have seen more than half a century in the field of teacher training, no standards yet exist which are generally agreed to be the criteria for teaching success. He goes on to declare that the task of identifying effective teachers is crucial to teacher education, certification, selecting and promotion Copes (concluded that) 'the brutal fact is that in spite of over 2000 studies we have no objective criteria of what constitutes teacher competence'. In their presentation of American work in this field, Biddle and Ellen pointed out that social and physical influences modify a teacher's performance."

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Considering the citations in the above paragraphs, one cannot fail to apprehend the immense difficulty to be faced in seeking to measure or evaluate the effectiveness of teachers. If we regard effectiveness in teaching as an end operation producing desired results, we are at least faced with the problems of identifying the criteria of teacher effectiveness and developing means of eliciting suggestive behaviours. Rodger (1965) perceives some problems which effect the setting of criteria: difficulty in differentiating between objective and subjective criteria, variation of upheld values over time, and appreciating that not only must an individual fit his job but the demands of his job must fit his capabilities, are among the lot.

2.2 Factors which may contribute to teacher effectiveness

Since student growth and development result from all the experiences encountered by the student, it is difficult to distinguish the effects of the teacher from other agencies and institutions in the learner's environment. Various factors come into play with the teacher's intentional interaction with learners in order to bring about a change in their behaviours. Philips (1968) identified factors which may hamper the determination of teachers effectiveness as:

- i. the ability level of the class;
- ii. previously learned work habits of the class,
- iii. socio/cultural advantages outside the school, and
- iv. available teaching facilities and learning resources.

One may imply here that a bright class would still do well even where a teacher is not potentially effective, and that previous experiences of the learners can also enhance or deter the rate of learning. But McNeil and Popham (1973) believe that "a focus on pupils reveals far more about the effectiveness of teachers than does direct study of the teachers themselves". Considering the contentions of Phillips, McNeil and Popham, a conflicting situation arises. Whereas the ability level and the previously learned work habits of the class, and the socio-cultural advantages outside the school may be independent of the classteacher's influence, the available teaching facilities and learning resources in the classroom are greatly facilitated by the teacher. But all these factors contribute to the attainment of the instructional objectives being pursued.

So if teacher effectiveness is defined as the extent to which teachers aid students to attain the objectives of the curriculum, it would mean that the effectiveness of the teacher is measured in terms of variables both under and beyond his control. Thus if we believe, like McNeil and Popham, that a focus on pupils reveals far more about the effectiveness of teachers, then we must contend that whatever behavioural changes are exhibited by pupils result from the teacher's active manipulation with the learning environment, as well as his potentials. Extraneous factors then become insignificant. Teacher effectiveness appears more clearly defined when considered to imply the extent to which desired results are produced or attained; that is, competence obtained from the learning process. Despite such a guideline, however, there exists the problem of identifying significant dependent variables which actually determine teacher effectiveness. These variables may be length of teaching experience, teaching methods and communicative skills, facilities available in classrooms, teacher's knowledge of subject matter, behavioural changes exhibited by learners, time and effort spent preparing lessons and several others. Such variables are considered ⁱⁿ developing the instruments for data collection used in this study.

2.3 Research findings on pertinent questions

In an attempt to establish criteria for evaluating the notion of teacher effectiveness, related studies have been undertaken and their findings have shed light on some pertinent questions. Some of these questions concern the effectiveness of teaching and learning against the background of the school environment, class size, in-service education for teachers, relative time spent on drill and practice, etc. The investigator considers the findings in the following paragraphs as valid, in general, and uses such findings as bases for judging teacher effectiveness in this study.

With regards to the question as to whether children learn more mathematics in good schools than in poor schools. Coleman and others (1966) concluded that:

"Variations in school quality are not highly related to variation in achievement of pupils

The school appears unable to exert independent

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Some investigators like Anthony (1968) have turned to analysing aspects of the classroom itself for the reason that the environment is linked to pupil achievement. Pupils interact with elements other than the teacher in the classroom, but the teacher may manipulate many of these elements. Thus, it is argued, a fair and relevant criterion of teacher effectiveness is the manipulation of environmental elements in the classroom. McNeil and Popham (1973) on 'The Assessment of Teacher Competence' asserted that "too typically, classroom environment is viewed as an end—teacher's awareness of physical environment, care of property, management of pupils, teaching techniques and materials."

The San Diego school system study ("Report to the Board", 1965) produced evidence suggesting that small class size favoured achievement in arithmetic at the (earlier) grades 1 - 3. But Menniti (1964) found evidence of significant difference in achievement in Mathematics in favour of small classes for the below - average and average pupils. However, he found no significant differences between classes of various sizes for upper IQ groups. It was thus concluded that small classes do not automatically bring about significant increases in achievement.

Investigations of Milgram (1969), Shipp and Deer (1960), Zahn (1966) and others accumulated evidence that suggested that children learned arithmetic skills better by spending less time on drill and practice and more time on meaningful developmental activities. Activities classified as 'developmental' refer to classroom procedures intended to increase understanding concepts such as teacher demonstrations, teacher explanations, group discussions, working with manipulative materials. On the other hand, 'drill and practice' activities include assigned exercises from books.

Houston and De Vault (1963) concluded from their study on in-service education of teacher that:

- (a) In-service education was effective in increasing mathematics education achievement both pupils and for teachers;

(b) there was a negligible relationship between teachers' initial mathematical achievement prior to the inservice education programme and the pupils' growth in mathematical achievement during the programme, and;

(c) growth in understanding of mathematical concepts of the in-service programme was related to pupils' growth in understanding those mathematical concepts.

Hand (1967) and others have suggested that such variables as the type of instructors for the in-service course may also have an effect on achievement of students and tutors. Colmez (1978) appreciates that teachers at the elementary schools are generally not mathematics specialists and so have only a shallow knowledge of the subject. He further notes that when reform in mathematics is accompanied by reforms in other subjects of the curriculum, all of which the teacher has to teach, "the burden of extra work and dispersed efforts accordingly slows down personal development in mathematics." A reform, whatever it may be, can only succeed if the teachers involved in the exercise understand its aims, master its content, and are capable of modifying their teaching methods as a result. Teachers' reactions to a reform are widely different. It may generate enthusiasm for some, willingness and effort for most and, for a few, even refusal. Considering these points, among many, the necessity of in-servicing, in addition to close supervision of teachers, in a reform programme cannot be overemphasized.

2.4 Towards developing Mathematical Concepts.

Major drawbacks in the teaching of mathematics in the past have been the disregard for individual differences in learners as well as approaching the teaching of mathematics mainly by verbal instruction involving verbal explanation and working of exercises. Dutton (1964) described four major periods in the development of arithmetic teaching. One of these periods was the drill theory of teaching which so much appealed to Thorndike that in 1922 he advanced the theory that for every stimulus there was a particular response, and that the two were connected by a specific 'bond'. This stimulus response view of learning led to a consideration of elementary

mathematics as a vast range of isolated and specific skills that could best be learnt through various bonds. The four rules of number, (i.e. addition, subtraction, multiplication and division) associated with the teaching of mathematics in primary schools, are some of these bonds. Another period described by Dutton was that of new mathematics; new in approach more than in content.

An important contribution that influenced changes in Mathematics education is Gestalt psychology. Marsh (1970) quoted R.A. Wheeler's plea for the teaching of mathematics in Gestalt terms:

"Therefore forget drill. Prepare work logically and concentrate on relations."

Commenting on the 'Meaning Theory' evolving before Piaget's experimental work, Marsh (1970) described the theory in these terms:

"arithmetic is a closely - knit system of understandable ideas, principles and processes; drill is a means of securing retention when an idea or process is already understood".

Marsh also quotes Brownell's (1941) description of meaningful arithmetic as social situations supplemented by learning activities deliberately designed to (a) make number operations sensible, (b) encourage children as rapidly as they safely can to adopt procedures that make for arithmetical efficiency". Piaget's experimental work has also thrown light on appropriate mathematical activity for young children. His outlined stages of thought considered the period around seven to eight years of age (age of P.1 children in the Gambia) as the Concrete Operational stage. At this stage, a child is able to form concepts or classes, relations and numbers, together with ideas of space and time, but there are still limits to the extent to which the environment can be understood. Such operations are not yet logical operations and 'they are only mastered in concrete situations where the child is actively manipulating data, which he can touch and fixate'

The use of concrete materials to aid learning is underestimated by many primary school teachers. They have failed to realize that children, unlike adults, cannot abstract concepts without manipulating with concrete aids. Marsh quotes Beard's comment on the purpose of using an apparatus:

"Piaget finds in Primary School children that mathematical thinking depends on the use of concrete aids and, in general, it is not until adolescence that facility with language and symbols makes it possible to reason from hypothesis, to imagine various possibilities and to deduce the consequences which should follow."

It may seem, from this quotation, that Piaget is suggesting that concrete aids automatically generate mathematical concepts. But in actual fact, concepts are derived from the operations performed with the materials. In this regard, Lovell (1961) contends that "mere perception and imagery in relation to the materials (aids) do not necessarily permit these mental operations, i.e. true thinking".

As a result of their contact with older school-going children, many of the children, before entering Primary 1, can count up to 20, at least. But this counting ability is merely based on rote learning, and not on an understanding of the cardinality of the number symbols they sound out. Marsh points out that 'many teachers have not been sufficiently aware, in their classroom work, of one-to-one correspondence situations and the ordinal aspect of counting.' Besides, counting activities are not realistic unless teachers use appropriate forms of apparatus to develop number ideas. The importance of structural materials in the early years of studying mathematics cannot be overemphasized. Appropriately chosen materials can allow children to discover concepts for themselves with the minimum of direction from the teacher (Diennes, Z.P., 1964). Marsh (1971) further points out that structural materials lead to a greater stress by teachers on the interrelatedness of the processes; and they provide an opportunity for the child to correlate the 'concrete', the 'visual' and the 'action' aspects of number, and the selective organization of the materials provides the 'maximum of intuitive clarity'.

The Gambia Primary Mathematics Course takes cognizance of the importance of using structural materials to develop mathematical concepts and, for Primary 1, it suggests materials such as Cuisenaire rods or its improvised equivalent (e.g. number strips of length 1 to 10 units). This study therefore looks into the sensible use of structural materials by teachers as a basis of evaluating the effective teaching of the Primary 1 mathematics course.

2.5 Problem of Methodology

One problem pertinent to classroom research is that of studying pupils or teachers without inducing changes in their behaviour as a result of the presence of the investigator, whether an observer, a recorder or an administrator of an instrument. This problem cannot be avoided, but may be minimized by avoiding disruption of the classroom, physically, and the pupils, emotionally. Dunkin and Biddle (1974) mentioned Samph (1968) to have cited that one researcher found that teachers who knew they were being observed were more responsive to pupils than teachers who could not be certain whether or not they were being observed. Thus, it is believed that the simplest method for collecting data about teaching is informal observation. In informal observation the observer performs the tasks of recording and encoding which involves data analysis, synthesis and interpretation of results. In this regard, however, Dunkin and Biddle contend that conclusions reached in the process may be biased, but since many insights can be gained by studying teaching on an informal basis, this method should not be eschewed. Furthermore, they maintain that systematized informal observation serves as a major techniques for generating hypotheses about previously unresearched settings; nevertheless when we want to test hypotheses or to establish the validity of relationships among informal variables for a range of classrooms, teachers or pupils, informal observation is not a particularly good technique for the task. This study, however, does not aim at either testing hypothesis or establishing the validity of relationships among variables in the teaching and learning, rather, ^{it} looks for bases to make generalization about ^{the} content of teaching and learning.

through observations of teacher's and pupils' responses to stimuli generated by research instruments developed for this study. As far as observation of classroom activities are concerned, Dunkin and Biddle summarized that observational instruments for research on teaching may be classified as sign or categorical systems, depending on whether the coder is given the task of looking for the occurrence of independent events (from a list) or whether he must judge all events of a given class for the category into which they fall (from a list provided). In this study, however, the investigator does not see the usefulness of categorizing behaviours into mutually exclusive events since it is believed that the study concerns classes of more than 30 different pupils interacting with each other continuously. Besides, in teaching as well as in learning, events are very much interrelated and as such dependent. Thus this study uses instruments which are interrelated as regards the feedbacks they elicit, not paying attention to categorization.

Commenting on process - product research concerning teacher effectiveness, McNeil and Popham asserted that:

"the most common practice is to associate teacher behaviour with student outcome measured via a correlation study. The independent variables are usually scored from either a frequency count of specific observable teacher actions, or check marks on rating scale that calls for an observer making inferences about the teacher. Measures of the dependent variables are descriptive notions such as student's test scores on cognitive measures or indicators of changes in attitude."

Such an approach to enquiring into teacher effectiveness may enhance the provision of conclusive information. However, there is the possibility for inconsistencies to arise unless investigators use operational definitions of variables which clearly specify observable behaviours. Particularly, rating scales have difficulties connected with their use. According to Dunkin and Biddle (1974), the rating instrument often needs observers to make high - inference judgements, and there is the tendency for biasness on the part of the observer.

CHAPTER 3METHODOLOGY AND DESIGN3.1 Sample Procedure

The subjects of the study were the pupils of primary one, and the teachers responsible for teaching mathematics in primary one, of the sample schools. Headteachers and supervisors of teachers were excluded in order to avoid the complexities of compromising widely differing opinions and unusual biases. Pupils were a mixture of boys and girls of about eight years old who could not read even simple English sentences comprehensively. The teachers were a mixture of trained and untrained personnel of varied lengths of service and experiences.

In view of the long distance that need to be covered in order to visit all the primary one classes throughout the Gambia, and the amount of time and finance required to facilitate such an extensive study, the target population for this study was greatly reduced to enhance manageability. The sample for this study was systematically chosen from a stratified population. It included primary schools of small, medium and big sizes; of poor, average and good facilities; and also schools in urban (U); semi urban (SU) and rural (R) areas. In the context of this study, urban areas are towns, not necessarily near to the capital city, Banjul, with modern social facilities such as piped - borne water supply, electricity, recreational amenities, hospital or health centres, police post, retail and wholesale shopping facilities, post offices, public library, etc. Rural areas are mainly agricultural and lack the facilities enjoyed in urban areas except small - scale retail shopping facilities. Semi-urban areas enjoy to a lesser degree some of the facilities present in urban areas, but agricultural activities are also significant. Hence, on the average, the socio-economic background of children in urban areas is richer than that of children in rural areas.

Prior to the administration of the research instruments, the researcher visited each of the sample schools and sought the permission of the headteacher to carry out the study.

The purpose and procedure for implementing the study were explained and the researcher asked to be introduced to the Primary One (P.1) teachers and pupils concerned. The class timetables were studied and appointments fixed for two periods; one period was to be used to observe the teacher teaching a lesson, and the other for the researcher to administer test items whilst the class teacher completed his questionnaire. All the instruments were administered by the researcher himself so as to check against unanticipated misunderstandings and also to maximise returns. Names of schools were not to be indicated; each school was instead given a code number only known to the researcher. Table 1, shows the sampling details of the study.

TABLE 1
SAMPLE SCHOOLS

School Code No.	No. of Streams	No. of P.1 Classes Studied	Total No. of Pupils Studied	Location of School	Distance of School from Banjul (Capital)
1	2	2	82	U	0 km
2	2	2	85	SU	26km
3	2	1	45	U	0 km
4	2	2	85	U	0 km
5	4	2	90	SU	16 km
6	2	2	79	R	45 km
7	4	3	120	SU	15 km
8	1	1	40	R	165 km
9	2	2	84	U	371 km
10	1	1	37	R	194 km
11	2	1	26	R	312 km
12	3	2	89	R	13 km
13	5	3	134	U	13 km
14	2	2	36	R	25 km
15	2	2	81	R	51 km
16	2	2	69	R	76 km

3.2 Instrumentation

From the various research reports read the investigator is convinced that any set of criteria for predicting teacher effectiveness cannot be an absolute matter since it depends upon the interested party, the type of pupils or teaching subject, or even the stage of educational career considered. However, a set of specific criteria need to be identified in order to make any objective study of teacher effectiveness. In appreciation of their relevance to this study, the investigator has considered some of the criteria of teacher effectiveness, provided by the American Research Association, in planning this study. These criteria are:

- i. Teacher's effect on pupils' achievement of current educational (instructional) objectives;
- ii. teacher's opinions, values, attitudes;
- iii. teacher's knowledge of subject matter;
- iv. teacher's interest in the teaching and learning of the subject matter.

Other criteria, such as, the ability level of the class, the experience and training of the teacher, socio-cultural advantages outside the school and available teaching facilities and learning resources in the classroom, have also been considered. On the basis of these criteria and other findings exposed by previous researchers into teacher effectiveness (cited in my Review of Literature, Chapter 2) and elsewhere, research instruments were constructed to elicit information on the extent to which these criteria and findings are served in the process of teaching mathematics in Primary 1, in the Gambia.

In order to facilitate the collection of sufficient data, this survey used observation and assessment guides, questionnaires and test items. The exact text of these research instruments are appended as Appendices A1, A2 and A3. The instruments used sought to elicit objective responses as much as possible so as to avoid opinionated feedbacks. Also, the use of written tests or exams on teachers, to evaluate teacher effectiveness, was avoided for fear of the effect of practice, especially when the examination items are based on what the teacher teaches or emphasizes; it is the contention of several researchers as well as professional associations (e.g. American Educational Research Assoc., 1952) that the ultimate criterion

of a teacher's competence in his impact upon the learner more than direct manifestations of the teacher.

The observation and assessment guide was used to gather information about factors that may influence effective or successful teaching in the classroom. The factors considered are the training received by teachers, the size of the classroom, the ability of the teacher to prepare relevant lesson notes that would enhance the attainment of the mathematics instructional objectives, the potentiality of the classroom environment in enhancing effective learning, and the effective communication and organization during the teaching process. These factors are specified, as indicated in Appendix A2, in order to facilitate fairly objective scoring.

The questionnaire for teachers of Primary One was introduced by kindly asking teachers to be as open and frank as possible, and promising them that the information they provide will be treated in strict confidence. This questionnaire sought information about pupils' attendance of nursery schools prior to joining Primary One, as it is believed that nursery schools experience positively affects the child's performance in primary school, later. And about the teacher, it sought information concerning teaching experience and qualification, and attitude towards studying mathematics, in general and teaching mathematics in Primary One, in particular. In order to elicit information from the teacher concerning obstacles to successful teaching, the questionnaire sought the teacher's response to pertinent problems. Such problems focus on content mastery of topics to be taught, ability to understand and use the Teachers Handbook, facilities in the classroom, assistance available etc. In order to facilitate precise and objective responses the questions asked were short and of a closed type. It was believed ^{that} responses obtained from the questionnaire when analysed side by side the observations made on the teacher's lesson notes, classroom environment and the lesson taught by the teacher, the competency of the teacher will be appreciated more objectively.

The Achievement Test Items used in this study were administered on the pupils (of Primary One) alone; as explained earlier test items were not set for teachers. The purpose of these test items was to assess the extent to which pupils have attained the prescribed instructional objectives of the Mathematics Course for Primary One. In constructing the test, the

Primary One syllabus was referred to and the following test objectives derived:

1. Count the numbers in a set with up to 50 members.
2. Write any numeral for the whole numbers from 1 to 50.
3. Say and write the whole number preceeding or coming after any whole number between 1 and 50.
4. Add and substract, orally, whole numbers from 1 to 10.
5. Fill in spaces (boxes) with the whole numbers 1 to 20, in addition and subtraction of whole numbers arranged horizontally.
6. Tell and set times on a clock face at the full hour.
7. Make up amounts from 1 butut to 50 bututs (50b) using the set of Gambian coins: (1p, 5b, 10, 25,).
8. Identify straight and round lines.
9. Identify triangles, squares, rectangles and circles.

The first draft of the test items was pre-tested in three schools (one rural, one semi-urban and one urban) not among the sample schools. After item-analysing, and revising these test items, where necessary, the final draft of the test items was prepared ready for administering. Since pupils in Primary One are not able to read instructions meaningfully or understand word problems, the investigator avoided the use of test papers and instead used the media of short oral questions in English, the blackboard, and the appropriate local language. The shortage of time could not allow oral questions to be asked to every individual. Before a test commenced children were warned not to shout out answers but to put up their hands if they know the answer to a question. Also the usual sitting arrangement was not disturbed and pupils were left to remain sitting in groups.

3.3 Data Collection

The research instruments were used to collect data as follows:

1. Observation and Assessment Guide

The researcher asked for the teacher's lesson notes and referred to the appropriate Unit in the Teacher's Handbook of the Gambia Primary Maths Course for Primary One. The lesson notes prepared by the teacher, with respect to the maths lesson to be taught, was then graded using the criteria stipulated under Section A of the schedule (See Appendix A2).

The teacher was then asked to proceed with his teaching of the prepared lesson whilst the researcher followed the communication process and scored Section C of the schedule according to the criteria indicated (See Appendix A2).

At the end of the lesson, Section B of the schedule, on the classroom Environment, was graded accordingly (See Appendix A2).

Using the scores from 4 to 0 as interpreted by the score key on the Observation and Assessment guide, the average score of the teacher in his performance on Lesson Notes, Classroom Environment and Teaching Process was computed and a single score obtained. But before the final score was computed for a teacher, the investigator orally posed the teacher pertinent questions in order to clarify matters arising from the observation and so minimize invalid rating of the teacher.

ii. Questionnaire For Primary One Teachers

(Appendix A1)

The teacher was given the questionnaire to complete during the time the researcher was busy administering the Test Items. Before a questionnaire was finally accepted from a teacher, the researcher perused the responses and made sure that the questions were well understood and responded to reasonably. Where a response appeared unreasonable, the researcher discussed the issue with the respondent in order to ensure useful or meaningful feedbacks. All questionnaires were collected by the researcher himself.

iii. Test Items

(Appendix A3)

Test Items for pupils were administered by the researcher himself, and he made sure that the questions were well understood by pupils even it is meant using appropriate local languages to enhance effective communication. When a question was asked the researcher looked out for the proportion of the class with their hands up, and he noted this percentage. If at the first attempt, a child got the answer right the percentage noted was awarded as the mark earned by the class. But if the answer was got right in the second attempt by any other child, then three-quarters of the noted percentage was awarded to the class. Only two attempts were allowed for each question.

Where a question consisted of several parts, the average percentage scored was computed for the question as a whole. It was not practicable to obtain marks for each individual child because of time constraint and technical problems involved in constructing and administering the test items at this level.

3.4 Data Analysis

Since the concept of teacher effectiveness is a relative one, the data collected for this study was analyzed qualitatively. In analyzing the scores in the observation schedule, the criteria enumerated in the schedule were considered on the basis of the scores of respondents. Information derived was condensed in Tables in order to facilitate easy comparison and interpretation.

The responses to the items of the questionnaire for P.1 teachers were analyzed with regards to the issues considered under sections B and C of the questionnaire. These sections concern the potential of the teacher as an effective P.1 teacher, and the extent of the obstacles which the teacher faces in teaching P.1 mathematics. Information about pupils, obtained in Section 1 of the teachers' questionnaires is used as an ingredient for analysing pupils' performances in the Test Items set for them.

At the end of administering test items to any class, a mark (%) was scored the class as a whole. Such a mark was computed by averaging the marks (%) obtained in the individual question items constituting the test.

In analysing the data collected in this study, it is assumed that the criteria of teacher effectiveness (teachers' behaviour and characteristics, and instructional objectives) identified and reflected in the research instruments are valid. On the basis of this assumption the data collected in this study were interpreted. Since this study is not experimental but somewhat correlational and process - descriptive, the criteria identified were not manipulated or controlled. The tables of collected data, constructed from the responses and indications obtained from the research instruments, were used as bases for analysing the extent of teacher effectiveness in the light of findings of educational researchers, theories of educational psychology and the practical experience of the investigator.

CHAPTER 4DATA ANALYSIS AND DISCUSSION4.1 Class Size

Of the 30 classrooms studied, only 20% had roll of less than 40. 30% had roll of between 41 and 45 and 50% had a roll of 45 and over (see Table 2, below). This shows that over 80% of the classrooms involved in this study had over 40 children in them.

TABLE 2
CLASS SIZES

CLASS ROLL	NO. OF CLASSES IN SAMPLE
Less than 30	- (0%)
30 - 34	1 (3.3%)
35 - 39	5 (16.5%)
40 - 44	9 (29.7%)
45 - 49	14 (42.6%)
50+	1 (3.3%)

A survey on the differences between small and large classes was carried out by M.N. Olson, in 1977, in the U.S.A. The findings of this survey highlighted the relation of indicators of quality of classroom process to class size: the mean score of indicators of quality decreased with the increase in class size, both in elementary and secondary schools. As we know, students differ amongst themselves in many ways, some are brighter, better in some pre-requisite skill or knowledge, better motivated, etc. If democratization of education means anything, such individual differences, among many others, must be considered in the classroom situation. Besides large class size is undoubtedly a factor in producing behaviour that calls for frequent class intervention on the part of the teacher. It is common to observe that children in large classes tend to be more deviant, that is, inattentive or disruptive in behaviour; because the larger the classes, the less impact the teacher has on individual students, since it is then impossible to give class attention to each child.

It is not difficult to appreciate the negative effects unmanageable (large) classes have on the teaching and, in effect, learning of modern mathematics in Primary 1. Modern methods of teaching mathematics are activity oriented; instead of propagating rote learning, the teacher ensures that the child comprehends the reality behind the abstraction, and not merely symbol manipulation. Z.P. Diennes talks of "the more the merrier principle": He argues that in building up concepts it is important to give adequate experience of a varied nature from which the concept may be abstracted. The more varied the experience embodying the idea to be abstracted the more complete will be the concept. The Gambia Primary Mathematics Course takes cognizance of this principle. But developing concept through activities not only requires time but also close supervision and individual attention. How can a teacher effectively cope with such a demand when faced with classes of over 40 pupils who are in the concrete operational stage of intellectual development, and who need to play with constructs (objects of perception and thought) and also need space to do purposeful activities?

4.2 Teachers' Qualifications

TABLE 3
TEACHERS BY QUALIFICATION

QUALIFICATIONS	NO OF TEACHERS
Trained	14 (46.7%)
Untrained	16 (53.3%)
Studies Maths beyond Form 4	- (0%)
Attended 1979 In-Service Course for P.1 Teachers	11 (36.7%)

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Table 3 shows Teachers' qualifications with regards to professional training and also academic background in mathematics, since the two are complementary aspects of teachers' preparation for effective teaching. Fourteen of the thirty teachers involved in the study were qualified, that is, they had undergone an elementary teacher - training course successfully. But the majority of them, 16, were unqualified. This is to be expected since the majority of the teaching force in the Gambia, at the Primary level, are unqualified. Aggravating this unfavourable situation is the occurrence that only 11 of the 30 teachers had attended the In-service course organised in August 1979, to familiarize teachers of Primary One with the new curriculum materials (including mathematics) which were to be disseminated nationwide that year.

None of the teachers involved in the study had studied mathematics for more than four years in secondary schools. Even where teachers have had four years of post primary (secondary) schooling their achievement in mathematics is generally very low with respect to post - primary mathematics. Gage and Berliner (1975) commented on such shortcoming of teachers thus:

"The teacher cannot present what students need to know, cannot explain puzzling matters, cannot ask enlightening questions, and so on, unless he or she is fully at home with the subject at a level far in advance of students."

Professionalism in teaching requires a lifelong commitment to trying to improve one's teaching techniques and understanding of the subjects taught. Training is necessary to develop and sharpen skills, but teacher training in the Gambia, whether in-service or pre-service, is generally not well planned; the relationship between the ideal objectives of the training programme and the actual outcomes of the trainees is not complementary.

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4.3 The experiences of the teachers of Primary 1

TABLE 4
TEACHERS BY TEACHING EXPERIENCE

	PERIOD OF TEACHING (YEARS)				
	12+	9 - 11	6 - 8	3 - 5	0 - 2
IN PRIMARY 1	6(20%)	4(13 $\frac{1}{3}$ %)	1(3 $\frac{1}{3}$ %)	5(16 $\frac{2}{3}$ %)	14(46 $\frac{2}{3}$ %)
IN TOTAL	10(33 $\frac{1}{3}$ %)	4(13 $\frac{1}{3}$ %)	1(3 $\frac{1}{3}$ %)	8(26 $\frac{2}{3}$ %)	7(23 $\frac{1}{3}$ %)

The responses indicated in Table 4 show that a third of the teachers involved in the study have taught for more than 12 years and a fifth of the teachers have spent over 12 years teaching in Primary 1. Some of the teachers in the first category (12+) have taught for over 20 years and, in effect, they are well rooted in the traditional practice of teaching mathematics: the notorious rote - learning process. Over 53% of the teachers studied had taught in Primary 1 for more than 3 years and as such they have been exposed to the new mathematics curriculum materials for Primary 1 which have been disseminated since October 1979 to all primary schools in the Gambia. However, about 47% of the teachers involved in this study have not taught Primary 1 for more than two years; which means that they did not attend the 1979 in-service course. It should be borne in mind that other in-service and pre-service courses, unlike those organized for dissemination - class teachers, have not been focussing their instructional objectives on developing the competency of their participants in the use of the newly developed curriculum materials - the Teacher's Handbook and the Pupil's Workbook. Thus it is doubtful how effectively young teachers, who have not received relevant in-service or pre-service training, can cope with the demand of the new curriculum. One may argue that the existence of experienced teachers side by side inexperienced teachers would solve or minimize the problem of incompetency even in the teaching of mathematics in Primary 1. But the big question is: how far is teacher experience correlated with teacher effectiveness? Research carried out by Rosenshine (1971) yielded a weak correlation between years of teaching experience and the average achievement

of the teacher's students. This weak relationship suggests that experience, or practice, alone is far from enough to qualify a teacher as excellent and, as such, a potential guide.

4.4 Lesson Preparation

After looking into the phenomena of class size, teacher's qualifications and experience, all of which have impact on effective teaching, the investigator then looked for more direct information concerning the teacher's preparation and effective communication during the teaching process. Such information was derived using an observation schedule that enumerated criteria for rating teachers on their notes, classroom environment and means of communicating with pupils during the course of the lessons observed. Teachers were rated on a five - point scale (4,3,2,1,0) interpreted as very good, good, average, below average and unsatisfactory, respectively. Table 5, below, indicates the ratings of lesson notes under the identified categories.

TABLE 5

TEACHERS' RATINGS ON LESSON NOTES

C R I T E R I A	R A T I N G				
	4	3	2	1	0
Relatedness of lesson objectives to the Unit	-	-	4	15	11
Appropriate choice of teaching aids	-	1	4	9	16
Appro. choice of teaching/learning activities	-	-	5	13	12
Appropriate choice of practice examples	-	-	6	21	3
Appropriate choice of evaluation exercises	-	-	3	13	14

Of the 30 teachers whose lesson notes were inspected and rated, none was rated 'very good' in any of the five categories considered (Table 5), and only one was rated 'Good' with regards to appropriate choice of teaching aids. 50% of the teachers rated 'Below Average' with regards to relating the lesson objective to the unit objective of the course, and about 70% rated 'Below Average' with respect to their proper choice of practice examples. Over 50% of the teacher rated

'unsatisfactory' with regards to 'appropriate choice of teaching aids'. These results indicate that teachers do not use the Teacher's guide to prepare their lessons: lesson objectives do not relate to the unit objective of the course intended to be taught, and recommended teaching materials are not used. Besides, the suggested lesson activities and evaluation exercises are not followed, and the practice exercises set for pupils are often inappropriate. In view of the fact that a lesson note is the final major stage of preparation before a teacher is ready to engage in actual active teaching, it is a suspect that teachers do not give serious attention to preparation of their maths lesson. As a result of improper lesson planning, and un-preparedness on the part of the teachers; lessons are bound to be unsuccessful.

4.5 Classroom Environment

In rating the environment of the classrooms involved in the study, the investigator focussed attention on the attractiveness of the classroom, its relative size, suitability of sitting arrangement and availability of necessary teaching aids. Table 6 shows the results that ensued.

TABLE 6
RATING OF CLASSROOM ENVIRONMENT

C R I T E R I A	R A T I N G				
	4	3	2	1	0
Attractiveness of classroom (ventilation, lighting, walls, etc.)	3	5	10	5	7
Size of classroom	2	7	10	10	1
Suitability of sitting arrangement	5	8	11	4	2
Availability of necessary teaching aids	-	-	-	-	-

With respect to attractiveness of classroom and size of classroom, about 66% of the classroom observed rated either average, good or very good. This situation is, however not consoling, considering that the 33% or so of the classroom, that were rated either below average or unsatisfactory, are significant. For the majority of the classrooms (60%) sitting arrangement was suitable to facilitate effective interaction

between pupils, materials and the teacher. Sitting pupils round tables, forming groups of six to eight not only recognized the need for group work at this stage, but also counteracted the inadequacy of materials to aid learning in the classroom. In contrast, however, about 90% of the classroom rated below average or unsatisfactory with regards to the availability of teaching aids for mathematics lessons. This is unfortunate in view of the fact that at this stage of intellectual development in which the pupils are - concrete operational stage - they are not mentally developed to form concepts in abstract. Piaget contends that from 7 - 8 years to 11 - 12 years of age, logical operations can be carried out with concrete materials or in a particular situation.

Modern teaching recognizes the fact that the process of education is influenced by the environment as well as by the teacher. Thus teachers should be conscious of the value of the classroom environment as an aid to effective teaching; that is, the classroom should provide an educational environment in which children will learn unconsciously. According to Farrant, the educational environment of the classroom should provide something of the excitement of a market, the awe of a museum, the fascination of a zoo and the interest and enjoyment that can be gained by browsing in a library.

4.6 Classroom Communication

TABLE 7

RATING OF COMMUNICATION ACTIVITIES IN THE OBSERVED MATHEMATICS LESSONS

C R I T E R I A	R A T I N G					
	4	3	2	1	0	
Efficient use of in teaching	-	-	4	19	7	(% OF TEACHERS)
Effective use of blackboard and other media	-	3	5	4	8	
Attention given to all pupils	-	1	6	22	1	
Ability to arouse pupils' interest in the lesson	-	2	6	14	3	
Evidence of learning from pupils	-	-	8	21	1	

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None of the 30 teachers involved in the study were rated above average with respect to efficient use of time, and only 13% of them were rated average. The vast majority (87%) were rated below average or unsatisfactory. With regards to the effective use of blackboard and relevant instructional media, about 50% of the teachers were rated below average; just 10% obtained the rating 'good' and about 17% rated average. 73% of the teachers were rated below average with regards to the attention given to pupils, in spite of the individual differences which do exist. Besides, the ability of teachers to arouse their pupils' interest in the on going lesson was generally below average; only 27% of them rated either good or average.

Evidence of learning of Primary 1 mathematics was inferred from the responses of pupils on the test items based on the stipulated objectives of the primary 1 mathematics course (refer to Appendix.....). For 68% of the 30 Primary 1 classes concerned, indications were that learning was below average.

The results featuring in the above paragraphs are pointers to the fact that teaching of mathematics in Primary 1 is not effectively done. Lessons are not efficiently planned, teaching aids and instructional media are not appropriately selected. Indeed, 'teaching aids' are aids to learning rather than aids to teaching since they help children to learn effectively. The teacher's work consists mainly of communicating experience to the child, and he has two main ways of doing this - by sound and by sight; and teaching aids help the teacher with both. Slow or backward learners are not given their proper share of the teachers' attention. Inadequate preparation of lessons coupled with poor teaching techniques render teachers unable to arouse pupils' interest in their lessons. All these inadequacies are obstacles to the effective teaching of mathematics in Primary 1.

4.7 Attitude of Teachers

TABLE 3

INDICATIONS OF TEACHERS' INTEREST IN TEACHING AND LEARNING OF MATHEMATICS

TABLE 8

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A STATEMENT	No. OF TEACHERS
Enjoy studying maths very much	19 (63%)
Enjoy studying maths a little	9 (30%)
Do not enjoy studying maths	2 (7%)
Like teaching maths in Primary 1 very much	21 (70%)
Like teaching maths in Primary 1 a little	6 (20%)
Do not like teaching maths in Primary 1	3 (10%)

According to Table 8, 63% of the teachers involved in the study responded that they enjoy studying maths very much and even a greater number (70%) indicated that they like teaching maths in Primary 1 very much. Only a small percentage of the teachers (7%) indicated that they do not enjoy studying mathematics and 10% admitted that they do not like teaching maths in Primary 1. Thus, on the average, about two-thirds of the teachers involved in the study tend to enjoy studying maths and also like to teach this subject. But the 30% of the teachers who indicated that they enjoy studying maths a little, and the 20% who responded that they like teaching maths in primary 1 a little, are not insignificant, considering that some of the ^{other} teachers might have even responded insincerely. Undoubtedly, the teacher's attitude and mathematical background are two important aspects that enhance effective teaching of mathematics. In view of the fact that the mathematical background of P.1 teachers is generally poor, it is a frightening pessimism if, in addition, such teachers are not disposed to improve their understanding of the maths content they are to teach. It is also disastrous for teachers to be given the responsibility of teaching maths when they are not keen in undertaking such a task. Colmez, writing on 'Teachers at the Pre-elementary and Primary Levels' asserted that another thing which frequently puts a break on the teacher's positive change of attitude is his feeling that he does not have a sufficiently thorough knowledge of the material to be taught. This is likely to be the case of most of the P.1 teachers who do not have the necessary knowledge and skills, which thus places them in a very uneasy moral situation with regards to teaching mathematics.

4.7 Pupils' attainment of Primary 1 Mathematics Objectives

Table 9 shows the scores of pupils in the 30 classes involved in this study in the achievement test administered by the investigator himself.

TABLE 9
RATING OF CLASS ACHIEVEMENT IN TEST OBJECTIVES

TEST OBJECTIVES	R A T I N G					
	0	1	2	3	4	
1. Count from 1 to 50	3	10	11	6	-	(NO. OF CLASSES)
2. Write the numerals 1 to 50	3	4	13	10	-	
3. Order numbers between 1 and 50	1	11	11	7	-	
4. Add and subtract the numbers, 1 to 10	3	10	13	4	-	
5. Substitute the numbers, 1 to 20 in simple addition and subtraction	21	7	1	1	-	
6. Tell time in the full hour	3	8	8	10	1	
7. Make amounts of money up to 50 bututs using a set of Gambian coins	19	9	2	-	-	
8. Identify straight and curved lines	12	8	5	4	1	
9. Identify rectangle, triangle, square and circle.	9	10	5	6	-	

Table 9 shows that just about 57% of the 30 classes involved in the study rated average or good in objectives 1 and 4, and 60% rated average or good in objectives 3 and 6. On the other hand, over 73% of the classes rated unsatisfactory or below average in objectives 5 and 7; 66% rated unsatisfactory and below average in objective 8 likewise for objective 9. These results may mean that P.1 pupils have at least average attainment in counting, writing and ordering numbers from 1 to 10, as well as telling time in the full hour. Also, it could be inferred that the attainment of P.1 pupils in substituting numbers (from 1 to 20) in addition and subtraction sentences, making amounts up to 50 bututs with Gambian coins, is unsatisfactory. Likewise, the attainment of P.1 pupils with respect to identifying shapes, straight or curved lines, is also not satisfactory.

Such unimpressive indications may be attributed to several factors such as:

- i. Over half of the P.1 teachers are untrained and lack the pedagogical background necessary to cope with the mental and emotional demands of pupils at this stage;
- ii. Most of the teachers do not use the Teachers' Guidebook for the P.1 mathematics course as a basic text in their lessons;

- iii. Teacher's lesson preparation and teaching activities are not closely supervised or monitored by headteachers or their deputies;
- iv. Teachers have not received relevant training in the use of the new Gambia Primary mathematics course materials;
- v. Suggested materials for use in teaching, and instructional activities to be followed in class are ignored by the teachers.

4.8 Problems of Teaching Primary 1 Mathematics

Table 10, below, reflects the extent to which identified problems, with regards to the teaching of the P.1 mathematics course, affect the teachers involved in this study.

TABLE 10
INDICATIONS OF TEACHERS' PROBLEMS

A S T A T E M E N T (OF PROBLEMS)	NO. OF RESPONSES
Some of the topics are new to me and I have not understood them	11 (37%)
I find it difficult to find time at home to prepare my lessons adequately.	16 (53%)
Some of the suggested teaching materials are not available in school and I can't improvise them.	24 (80%)
My classroom is congested and I do not have enough room to carry out some of the lesson activities..	10 (33%)
Suitable furniture is not available in my class-room	16 (53%)
I do not have anyone to help me when I face difficulties in preparing my lessons	6 (20%)
I do not find it easy to make up more exercises to supplement those given in the Pupil's Book.	4 (13%)
The teacher's Handbook is difficult to follow; I can't understand what the activities suggest.	8 (27%)

80% of the teachers involved in this study responded that some of the suggested teaching materials are not available in schools and they cannot improvise these materials. 53% of the responses show that the teachers find it difficult to find time at home to prepare their lessons adequately and, also, suitable furniture is not available in their classrooms. 37% of the teachers admitted that some of the topics in the P.1 maths course are new to them and they have not understood them; and

33% pointed to the fact that their classrooms are congested and that they do not have enough room to carry out some of the lesson activities.

Some of the responses above are significant in that they highlight pertinent problems which need to be solved if the teaching of mathematics in P.1 in the Gambia is to be effective. But to solve any problem, just like treating any illness, the root cause should be identified. As far as the teaching of mathematics in Primary 1, in the Gambia, is concerned, the attendant problems are fundamental. For those P.1 teachers who are qualified, their training in the teaching of mathematics is grounded in the traditional rather than the modern activity approach; and for the unqualified, they are generally unmindful of methodology and merely teach the way they were taught in Primary 1. The idea of a 'set' is strange to many teachers; they do not realize that the notion of a set is fundamental and that it naturally introduces the concept of number. In effect children merely learn to read and write numerals without being able to match them with the number of objects they represent. Availability of teaching aids is no less a problem, not only because teachers lack the skill to improvise them, but they most probably lack the enthusiasm to spend extra time at home to prepare such materials. This tendency is evidenced by the assertion of some teachers that they do not have sufficient time to prepare their lessons at home. In the case of women teachers, it may be that their domestic obligations are usually heavy enough to spare them little or no time to reflect on the lessons they are to teach subsequently. The dire shortage of school furniture negates effective teaching. In the early stage of learning to do mathematics, children need to manipulate with objects and move around, but such activities are restricted when more than an optimum number of children are crowded round a table, or they are disposed to use unsuitably improvised furniture, which causes more strain to the children than they do facilitate easy learning in the classroom. Relatively few of the teachers admitted that they cannot easily follow the suggested activities in the Teacher's Handbook for Primary 1; but the investigator questions the validity of such assertion in view of his observations that

most of the lesson notes of teachers clearly showed that they do not develop their lessons from the framework laid in the Teacher's Handbook and the Pupil's Workbook. Furthermore, discussions with the teachers projected that the exercises set in the Pupil's Workbook are inadequate; and some teachers requested that work cards should be provided to supplement these exercises. If it is true that these teachers understand what they are prescribed to do, why can't they make their own supplementary exercises?

4.9 Seeking for Correlation between Variables

Table 11 shows the results of rating the teachers against an observation schedule and the achievement of pupils on a test based on the P.1 mathematics objectives. This table also indicates the rolls of the classes studied and the number of children who had attended kindergartens before enrolling in Primary 1.

The average rating on class achievement for classes in which one-third or more of the pupils have had pre-schooling experience was 1.5 (that is about average achievement), whilst the average rating for classes in which less than one-third of the pupils have had pre-schooling experience was 0.75 (that is below average achievement). Such observations may suggest that pre-schooling experience prepares the child to be able to cope with the formalised teaching of the P.1 mathematics course. But in four of the classes in which one-third or more had had pre-schooling experience, the class achievement rated unsatisfactory; and in two of the classes in which no child had had pre-schooling experience the class performance rated average (2). The investigator therefore believes that even if there is any correlation between pre-school experience and subsequent achievement in school, it is spurious; the teacher's potential appears to be a contributory factor towards pupils' achievement.

The highest rating of teachers through the use of the Observation Schedule was merely average (2) and, even there, only seven teachers had this rating. Correspondingly, the average performance of the classes taught by these teachers was rated average. Thus there seem to be a correlation between a teacher's potential preparation and the performance of the class taught by the teacher.

TABLE 11
RATING OF CLASS TEACHERS AND PUPILS (in classes)

CLASS CODE NO.	NO. OF PUPILS WHO ATTENDED KINDERGARTENS	TEACHER'S RATING ON OBSERVATION SCHEDULE	CLASS RATING ON ACTIVITY TEST
01A	20	1	2
01B	14	1	2
02A	17	2	2
02B	17	1	2
03A	30	2	3
04A	39	1	2
04B	9	2	2
05A	4	2	2
05B	12	1	2
06A	-	1	1
06B	-	1	0
07A	39	2	1
07B	2	0	1
07C	26	1	1
08A	-	1	0
09A	17	1	0
09B	6	0	0
10A	-	1	1
11A	-	1	0
12A	-	1	0
12B	-	1	0
12C	-	1	0
13A	13	1	0
13B	22	1	0
13C	31	1	2

TABLE 11. (D):

CLASS	NO. OF PUPILS WHO ATTENDED KINDERGARTENS	TEACHERS RATING ON OBSERVATION SCHEDULE	CLASS RATING ON ACHIEVEMENT TEST
14	-	2	2
14	-	0	0
15	-	1	0
15	-	2	2
16	-	1	0

RATING KEY

4 - Very Good 2 - Average 0 - Unsatisfactory
 3 - Good 1 - Below Average

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CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Assumptions underlying the conclusions arrived at in this study.

This study is primarily concerned with deducing the extent to which the objectives of the prescribed mathematics course for primary 1, in the Gambia, are realized as a result of organized teaching strategies. In pursuing this end, the investigator contends with the belief that the teaching process is so complex, and the number of variables affecting it are so great, that a precise definition of effective teaching is wishful thinking. Particularly that this is a small scale study, the investigator does not claim definitive findings establishing cause - and - effect relationships. However, it is hoped that the findings exposed will have considerable value, at least, in challenging interested educators to undertake more rigorous studies into the subject of teacher effectiveness; for they would have had a slice of reality against which they can sharpen their concepts, theories and instruments.

In view of the difficulty of establishing cause - and - effect relationships with respect to the concept of teacher effectiveness, the findings of this study are based on certain assumptions derived from the findings of previous studies into the concept of teacher effectiveness, and the teaching of mathematics in primary schools, in particular. It is assumed that the extent of students' learning has obvious strength to form a basis for appraising teaching provided that uniform conditions are operational. Among these uniform conditions are same instructional objectives, same textbooks, socio-cultural background and student intelligence. As far as this study is concerned, discrepancies in these conditions are negligible. Another assumption is that the sequence of instruction or classroom communication between pupils and the teacher is indicative of effective teaching. The teacher first of all needs to be aware of his informative or managerial roles before preparing his lessons. In the process of teaching and learning, the teacher should always observe pupils' performance; if they are satisfactory, he reinforces the behaviours exhibited and finally obtains pupils' feedback; On the other hand, if pupils' performance requires modification, the teacher gives necessary directive and finally obtains

feedbacks from pupils. Thus effective teaching would involve not only the teacher's knowledge of the subject taught, but also the teacher's preparation and the method used to bring about desired behavioural changes in learners.

5.2 Restatement of findings

Indications from the responses of teachers to their questionnaire, the performance of pupils in the test items administered and the observation of classroom environment and teacher/pupils interaction, suggest that the effective teaching of mathematics in primary 1 in the Gambia is negated by the following general occurrences:

- (i) Classes are unmanageable either because of big roll or inadequate equipment;
- (ii) teachers are not adequately trained to cope with the demands of the instructional materials they are supposed to use;
- (iii) teachers do not adequately prepare for their lessons;
- (iv) classroom environments are not conducive to learning mathematics;
- (v) teachers' attitude to teaching and learning mathematics is negative.

The implications of these findings with respect to the teaching of P.1 mathematics is evident in the following paragraphs.

Big classes restrict effective learning in many ways. Individual attention cannot be given by the teacher when there are so many pupils to care for, and even where the pupils are grouped according to abilities, the inherent wide range of abilities necessitates the existence of several of such groupings. As a result of unmanageably big classes teachers are prone to be more theoretical than practical in their deliberations, much against the pedagogical needs of children of eight years old. In some cases where the roll is manageable, shortage of suitable class furniture and equipments restricts effective learning. Shortage of furniture necessitates overcrowding of pupils which, in effect, inhibits free activities so much needed to generate mathematical ideas and relations at this stage. Besides its concern with pattern or structures which can be pictured in the mind, mathematics is concerned with operations on these mental pictures. Such

mental images are created by varied experiences with things through observation, handling, construction etc., but these activities cannot be facilitated in the absence of the necessary learning aids.

Inadequate academic background and professional training impede effective teaching at any level. It is a serious mistake for people to think that P.1 classes can do well even with teachers who are not well grounded in the subjects they teach. This misconception arises from the failure to realize that if teachers do not thoroughly understand the fundamentals of the ideas they are to develop, they would not be able to stimulate the mathematical thinking of their pupils as well as clarifying their misconceptions. Thus, considering the situation that about half of the P.1 teachers in the Gambia are unqualified and of rather weak academic background, the effectiveness of teaching P.1 mathematics becomes threatened. Even with the existing qualified teachers in P.1, they are, by virtue of their training, not conversant with the approach and methodology of the present curriculum materials, particularly in mathematics. In the process of teaching mathematics, it is very common to find teachers merely working through the exercises set in the pupils workbook rather than first of all going through the developmental activities suggested in the Teacher's Handbook, using the appropriate teaching aids. Generally, communication in the classroom is inactive. Many teachers spend much of their time directing class activities from the front of the class. As this stage, in P.1, such single channel communication is unsuitable; rather, the teacher needs to use more channels, moving about the class and working with individuals or small groups physically arranged around clusters of desks or working surfaces, and facilitating verbal interaction by pupils within and across groups, and with the teacher himself.

From the observation of teachers' lesson notes and actual teaching activities, it is indicative that most of the P.1 teachers do not prepare their lessons adequately. Lesson notes lacked information of practical utility to the teacher; lesson objectives were vaguely defined, appropriate teaching aids were not identified, lesson activities were mostly irrelevant to the unit objective aimed at, and evaluation exercises were generally unsuitable for determining the extent of pupils achievement with respect to the intended lesson objectives. Besides the poor preparation of lessons, the classroom environments were usually dull and unstimulating.

Walls were mostly bare, class shops non-existent or dusty through neglect, and even basic teaching aids were far from sight. The common complaint of teachers, that the teaching aids they are supposed to use are not supplied by the school authorities, is inexcusable; for all these teaching aids can be improvised using scraps or very cheap materials found in the immediate environment of the school.

The attitude of the P.1 teachers towards the teaching of the current P.1 mathematics course is rather ambiguous. Probably, they realize that they have not been adequately trained for their task or that their deliberations are not monitored by their supervisors and, as a result, they are not motivated to implement the specific changes required of them. Some of the P.1 teachers do not like to teach mathematics and only do it perfunctorily, and some also dislike studying mathematics even where this is necessary to improve their understanding of the concepts they should teach. To some extent, the official P.1 mathematics course for the Gambia exists in a vacuum for it appears from this study that while teachers are expected to follow the Gambia primary mathematics course (G.P.M.C.) materials, many of them only pretend to do so whilst they actually continue to teach the mathematics concepts they fancy by the old method they were taught. For example, two teachers were found working out the multiplication of three-digit numbers by one-digit numbers, on the blackboard (in P.1) while the pupils looked on and supplied answers to products called out by the teacher.

As a result of the drawbacks revealed, in the paragraphs above, it is not surprising that the general attainment of the P.1 mathematics objectives is below expectation and, as such, ineffective. A serious weakness with P.1 pupils is that whilst many of them can count from 1 to 50 in rote form, many cannot tell the number that precedes or follows a given number between 1 and 50. Also, given an amount between 5 bututs and 50 bututs, the majority of P.1 children cannot ^{form} this amount from a set of coins of denominations 1b, 5b, 10b and 25b. The underachievement of P.1 pupils could have been ameliorated if the teachers, besides undergoing appropriate training and developing positive attitude to teaching and learning mathematics, bore the following points in mind whilst implementing the P.1 mathematics course.

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- (i) Learning situations should be created to provide guided opportunities for children to acquire deeper understanding of mathematics, through their own activities, with little or no spoon-feeding. Such activities would include learning to compare, classify and look for patterns or relations.
- (ii) The materials (teaching aids) suggested for use in the Teacher's Handbook are very important in facilitating learning, and developing mathematics concepts, and must therefore be used when teaching.
- (iii) The method of evaluation should focus on direct observation of pupils at work, and also the assessment of individual and group work. A record of each pupil's achievement should be kept by the teacher, and remedial teaching must not be overlooked.

5.3 Recommendations

Considering the nature of the findings of this study, the investigator believes that, unless a systematic approach is taken to counteract the inefficiency that prevails as regards the teaching of P.1 mathematics in the Gambia, the objectives of the primary mathematics curriculum will not be realized. Not only will the revolutionized approach to teaching mathematics be crippled, but even the realization of mathematical skills and understanding, required for the social and cultural development of the individual going through the primary school system, will be impaired. In view of this situation the following recommendations are proposed.

- (i) Class roll should be controlled within a limit of 45 at most, and it must be ensured that there is enough space in the classroom to facilitate relevant learning activities.
- (ii) Classrooms should be minimally furnished such that pupils can be comfortably seated and provided with raised working surfaces (desks or tables) for writing etc.
- (iii) Teacher training must be made more relevant. All courses, whether in-service or pre-service, must be designed to enhance effective use of the current mathematics curriculum materials. In this regard, the activity method of teaching and the methods of testing and evaluating should be focussed on.

- (iv) As well as developing courses for the improvisation of teaching aids at the Training College, workshops should be organized, regionally, whereby serving teachers are taught how to use easily available materials in the locality to improvise teaching aids. There should be less dependence on imported teaching
- (v) An Inspectorate Division of the Ministry of Education should be set up to supervise the deliberations of teachers in their classrooms. To this end, headteachers and their deputies should be familiarized with the curriculum materials in use and be actively involved in supervising the teaching activities of their staff.

APPENDIX A1

QUESTIONNAIRE FOR PRIMARY ONE TEACHERS

In completing this questionnaire, you are kindly asked to be as open and frank as possible. The information you provide will be treated in strict confidence.

Do not write your name on this questionnaire.

SECTION A : INFORMATION ABOUT PUPILS

1. Number of pupils in the class?.....
2. Number of pupils in the class who have attended nursery schools or kindergartens?.....

SECTION B : INFORMATION ABOUT TEACHER

3. Status (write: qualified or unqualified).....
4. Number of years of teaching experience?.....
5. Number of years of experience in teaching Primary One.....
6. What is the highest class in which you have studied mathematics in school?
7. Did you attend the in-service course for the dissemination of Primary One curriculum materials in 1979?.....
8. Do you enjoy studying mathematics?
(Write: "very much," "a little", or "not at all").....
9. Do you like teaching mathematics in primary one? (write: "very much", "a little" or "not at all").....

SECTION C : INFORMATION ABOUT TEACHING

10. Which of the following have been your problem(s) in teaching the present Primary ONE mathematics course? (Tick (☒) one or more boxes as appropriate.)
 1. Some of the topics are new to me and I have not understood them. ☐
 11. The activities suggested in the Teacher's Handbook are too many and I cannot find time at home to prepare my lessons adequately. ☐

- iii. Some of the suggested teaching materials are not available in school, and I can't improvise them.

☐

- iv. My classroom is congested and I do not have enough room to carry out some lesson activities

☐

- v. Suitable furniture is not available in my classroom.

☐

- vii. I do not find it easy to make up more exercises to supplement (add to) those given in the Pupil's Book.

☐

- viii. The Teacher's Handbook is difficult to follow; I can't understand what the activities suggest.

☐

- vi. I do not have any one to help me when I face difficulties in preparing my lessons.

☐

OBSERVATION AND ASSESSMENT GUIDE TO EVALUATING PRIMARY ONE MATHEMATICS TEACHING

School Code No.....

Status of Class Teacher.....

No. of pupils attending lesson.....

Topic of lesson.....

Related Unit in P.1 maths course.....

A. LESSON NOTES

Relatedness of lesson objective(s) to Unit Objective	
Appropriate choice of teaching aids	
Appropriate choice of teaching/learning activities	
Appropriate choice of practice examples	
Appropriate choice of evaluation exercises	

B. CLASSROOM ENVIRONMENT

Attractiveness of classroom (ventilation, lighting, walls, etc)	
Size of classroom (optimum - 40)	
Suitability of sitting arrangement	
Availability of necessary teaching aids	

SCORE KEY

Very Good	- 4
Good	- 3
Average	- 2
Below Average	- 1
Unsatisfactory	- 0

C. EFFECTIVE COMMUNICATION (TEACHING PROCESS)

Effective use of blackboard and other media	
Attention given to all pupils	
Ability to arouse pupils' interest in the lesson	
Evidence of learning from pupils	

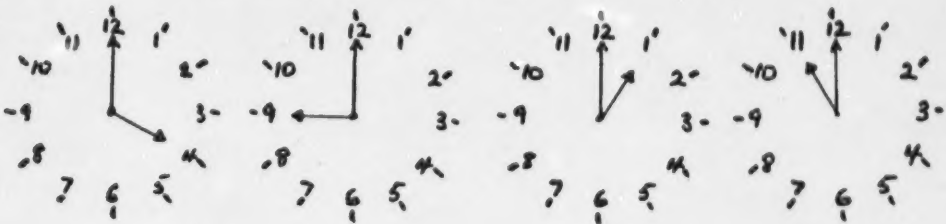
D. AVERAGE SCORE OF TEACHER IN A, B AND C

ACHIEVEMENT TEST ITEMS

PART 1 (ORAL)

1. How many teachers are there in the class? Write this number on the blackboard.
2. How many girls are there in the class? Write this number on the blackboard.
3. How many boys are there in the class? Write this number on the blackboard.
4. How many children in the class are wearing shoes? Write this number on the blackboard.
5. What is:
 - a. $(3 + 4)$?
 - b. $(8 + 2)$?
 - c. $(10 - 2)$?
 - d. $(10 - 4)$?
 - e. $(9 - 5)$?

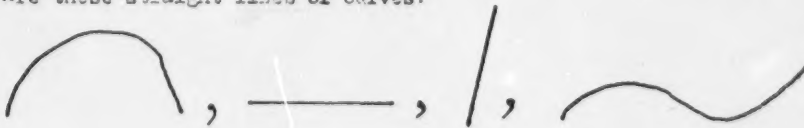
6. What is the time (shown on the clock face)?



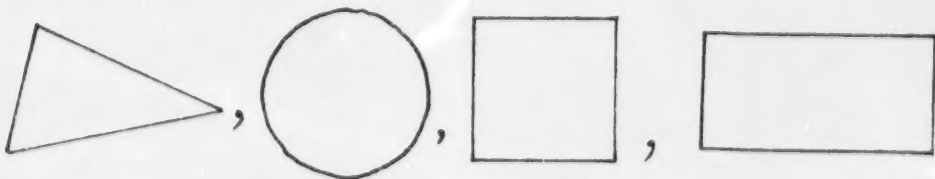
7. Show each of these times on the clock face:

a. 8 O'Clock b. 3 O'Clock c. 6 O'Clock d. 7 O'Clock

8. Are these straight lines or curves?



9. What is each shape called?



10. Fill in the missing numerals:

3	4	5		7	8	
	11	12			15	
	18		20			23
		26		28		
31			34			
38		40			43	
	46			49		

11. Pick out butut coins to show each amount:

- | | |
|--------|--------|
| a. 30b | e. 37b |
| b. 35b | f. 39b |
| c. 40b | g. 47b |
| d. 45b | h. 49b |

PART 2 (WRITTEN)

12. 11	13. 13	14. 18	15. 15
<u>+5</u>	<u>+7</u>	<u>-6</u>	<u>-9</u>
—	—	—	—

16. $3 + \square = 5$	17. $\square - 7 = 2$
-----------------------	-----------------------

18. $19 - \square = 1$	19. $\square + 8 = 17$
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APPENDIX B

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